

SLINGER AND WEAR SLEEVE SEAL ASSEMBLY

BACKGROUND OF THE INVENTION

- [1] The present invention relates to a seal assembly, and more particularly to an integrated slinger and wear sleeve seal assembly.
- [2] Current unitized seal designs are relatively complicated assemblies which seal rotational interfaces such as where a yoke exits/enters an axle housing. Conventional seal designs are implemented to reduce the difficulty of assembly and to eliminate the requirement to change yokes after a seal failure. A unitized design includes rubber internal bump stops to preload excluder lips during yoke installation and a running surface sleeve for a main seal lip interface. The bump stop and running sleeve interaction may create seal assembly and longevity issue tradeoffs.
- [3] Disadvantageously, the rubber bump stops increase thermal generation, through friction which is transferred to the seal element and may effect seal longevity. Reduction of the bump stops size, however, may fail to properly locate the excluder lips during yoke installation
- [4] A resilient insulating material such as rubber is also utilized within the inner diameter of the running sleeve to maintain static friction between the yoke and running sleeve to prevent relative rotation. Minimization of the insertion force of the yoke through the running sleeve reduces assembly complications. Increasing the rubber within the running sleeve reduces insertion force and insulates heat within the seal. Removal of rubber increases insertion force but more readily transfers heat to the seal.
- [5] In addition, a slinger stamping is often separately mounted to the axle housing to further protect the seal assembly. Aside from the additional component, some seal locations do not have the benefit of a separate slinger stamping because of the housing geometry.
- [6] Accordingly, it is desirable to provide a robust and uncomplicated seal assembly which incorporates a slinger into the seal assembly via the running sleeve to isolate the seal and eliminate the bump stops to set excluder lip preload.

SUMMARY OF THE INVENTION

- [7] The seal assembly according to the present invention provides a rotating portion which rotates with a yoke and a rotationally fixed portion which is mounted to a housing assembly.
- [8] The rotating portion includes a running sleeve, a slinger segment and an upper seal segment. The running sleeve and the upper seal segment are located generally parallel to an axis of rotation. The slinger segment radially extends outward of the fixed portion so as to protect the fixed portion.
- [9] The fixed portion includes a press fit outer diameter which is pressed into an opening located within the assembly. A seal mount segment located transverse to the axis receives a resilient annular seal which rides upon the running sleeve and the upper seal segment.
- [10] The present invention therefore provides a robust and uncomplicated seal assembly which incorporates a slinger into the seal assembly via the running sleeve to isolate the seal and eliminate the bump stops to set excluder lip preload.

BRIEF DESCRIPTION OF THE DRAWINGS

- [11] The various features and advantages of this invention will become apparent to those skilled in the art from the following detailed description of the currently preferred embodiment. The drawings that accompany the detailed description can be briefly described as follows:
- [12] Figure 1 is a general side view an axle housing for use with the present invention;
- [13] Figure 2 is an expanded view of a first seal assembly;
- [14] Figure 3 is an expanded view of a second seal assembly;
- [15] Figure 4 is an expanded sectional view of the first seal assembly; and
- [16] Figure 5 is an expanded sectional view of the second seal assembly.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

- [17] Figure 1 illustrates a general side view of an axle housing assembly 10 having a forward drive yoke 12 and a rear ward drive yoke 14 which extend there from for rotation about an axis A. The assembly 10 drives a vehicle axle 15 such as that utilized by a heavy

vehicle as generally known. It should be understood that although a particular component arrangement is disclosed in the illustrated embodiment, other arrangements will benefit from the instant invention.

[18] The forward drive yoke 12 passes through a forward unitary input seal assembly 16 (also illustrated in Figure 2). The rearward drive yoke 14 passes through a rearward unitary output seal assembly 18 (also illustrated in Figures 3). It should be understood that relative positional terms such as "forward," "aft," "upper," "lower," "above," "below," and the like are with reference to the normal operational attitude of the vehicle and should not be considered otherwise limiting.

[19] Referring to Figure 4, the seal assembly 16 is illustrated in cross-section. The seal assembly 16 includes a rotating portion 20 which rotates with the yoke 12 and a rotationally fixed portion 22 which is mounted to the housing assembly 10. The portions 20, 22 are preferably stamped sheet metal components.

[20] The rotating portion 20 includes a running sleeve 24, a slinger segment 26 and an upper seal segment 27. The running sleeve 24 and upper seal segment 27 are located generally parallel to the axis A while the slinger 26 is arranged perpendicular thereto. The upper seal segment 27 is a U-shaped portion which extends back from the slinger segment 26. The upper seal segment 27 extends parallel to and is spaced away from the running sleeve segment 24 to form an annular seal cavity 29.

[21] The slinger segment 26 radially extends outward of the fixed portion 22 so as to protect the fixed portion 22. A slinger end 26a of the slinger segment 26 is preferably raked in the direction of airflow (illustrated schematically by arrow F) to further minimize the ingestion of debris into the seal assembly 16. Slinger extension 26b is adjacent slinger end 26a. Slinger extension 26b preferably does not extend radially outward as much as slinger end 26a. Slinger end 26a extends beyond slinger extension 26b for airflow protection. Slinger extension 26b is preferably of a diameter larger than 10 to prevent runoff of debris falling into the seal. With a larger diameter, the runoff will "roll" circumferentially around the sides and not fall into the seal.

[22] The running sleeve 24 includes a resilient seal 31 mounted therein to operate as a static seal. Resilient seal 31 preferably provides for static sealing. Preferably, metal-on-

metal contact is provided with only a short interval of resilient materials for static sealing. It should be understood that various seal arrangements in this location will benefit from the present invention. The rotating portion 20 is preferably assembled with a press fit onto the yoke 12 to contact a yoke shoulder S, however, other assembly procedures will also benefit from the present invention.

[23] The running sleeve 24 is preferably arranged to contact the yoke 12. Contact between the running sleeve end 24a and the yoke 12 provides a metal to metal contact which operates as a thermal transfer path away from a resilient annular seal 36. The fixed portion 22 includes a press fit outer diameter 32 which is pressed into an opening 35 located within the assembly 10. The press fit outer diameter 32 is generally parallel to an outer surface 27a of the upper seal segment 27. The outer diameter 32 is generally parallel to the axis A and terminates with a seal mount segment 34 which is generally perpendicular thereto. That is, the press fit outer diameter segment 32, the seal mount segment 34 form a generally question mark like shape in cross-section.

[24] The seal mount segment 34 receives the resilient annular seal 36. The annular seal 36 includes a groove 38 within which the seal mount segment 34 engages to locate the seal 36 adjacent the seal cavity 29.

[25] The seal 36 preferably includes a multiple of wipers 40 which ride upon the running sleeve 24. The wipers 40 form a labyrinth to prevent debris from entering through the seal 16. A reverse wiper 42 extends from the seal 36 to engage the upper seal segment 27. The seal 36 may additionally include a retainer channel 44 to receive an annular retainer 46 such as an annular spring. It should be understood that a multiple of seal geometries will benefit from the present invention.

[26] Referring to Figure 5, the seal assembly 18 is illustrated in cross-section and is of a construction as described above with regard to seal assembly 16. As the seal assembly 18 is rearward facing relative the housing assembly (Figure 1), a slinger end 26a' of a slinger segment 26' of seal assembly 18 is raked in the direction of airflow (illustrated by schematically by arrow F and opposite that of seal assembly 16 to further minimize the ingestion of debris in to the seal assembly 18. Such an integral slinger arrangement provides

for a slinger in heretofore unattainable locations as the slinger is internal to the rotating portion of the seal.

[27] Slinger end 26a' extends outward of slinger extension 26b'. Preferably slinger end 26a' is angled radially away from centerline A to operate as a drip edge for debris which thereby travel circumferentially around the seal rather than into the seal.

[28] The foregoing description is exemplary rather than defined by the limitations within. Many modifications and variations of the present invention are possible in light of the above teachings. The preferred embodiments of this invention have been disclosed, however, one of ordinary skill in the art would recognize that certain modifications would come within the scope of this invention. It is, therefore, to be understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described. For that reason the following claims should be studied to determine the true scope and content of this invention.